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# THE PLANT DISEASE REPORTER

Issued By

## THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

AGRICULTURAL RESEARCH ADMINISTRATION

UNITED STATES DEPARTMENT OF AGRICULTURE

SUPPLEMENT 206

PLANT PATHOLOGICAL INVESTIGATION  
IN THE UNITED STATES

V

Supplement 206

September 15, 1951



The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.





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## THE PLANT DISEASE SURVEY DIVISION OF MYCOLOGY AND DISEASE SURVEY

Plant Industry Station

Beltsville, Maryland

### \* PLANT PATHOLOGICAL INVESTIGATION IN THE UNITED STATES, V

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### RESEARCH IN PLANT PATHOLOGY AND BOTANY AT LOUISIANA STATE UNIVERSITY

C. W. Edgerton

The research work in botany and plant pathology in Louisiana State University and Louisiana Agricultural Experiment Station practically had its beginning when Adams Fund money became available in 1906. Previous to that date, W. R. Dodson, who later became director of the Experiment Station, made a study of the sugarcane plant and also reported on the weeds occurring in rice fields. Although at that time farmers and planters had become somewhat cognizant of such troubles as the black rot of sweetpotatoes, the cucumber mildew, and some trouble with sugarcane, practically no definite information was available in regard to the plant diseases of the State. Sugarcane planters were perhaps the first to ask for such information.

In 1906, H. R. Fulton was appointed as the first plant pathologist of the Station. During the two years that he held that position, he made some preliminary studies and surveys, and reported in bulletins on certain of the diseases of rice, peppers, and beans, and on the root rot of sugarcane.

In 1908, following the resignation of Dr. Fulton, C. W. Edgerton was appointed plant pathologist. As pathologist of the Station and later (1924-1950) as Head of the Department of Botany, Bacteriology and Plant Pathology in the University, he was in charge of the research in botany and plant pathology until his retirement in 1950. Upon his retirement, S. J. P. Chilton became Chairman of the department and is now in charge of the research work.

Starting from scratch, as would be expected, the additions to the department Staff were at first very few. C. C. Moreland was appointed as assistant in 1911 and remained on the Staff with the exception of a few years in the armed services until his resignation in 1924. The department began to expand in 1924 and this expansion has continued until the present time. Since 1924, the following have been added to the Staff in the Experiment Station: E. C. Tims (1924-date); I. L. Forbes (1925-date); E. V. Abbott (1925-26); P. J. Mills (1926-date); A. G. Plakidas (1927-date); H. H. Flor (1928-30); L. H. Person (1929-47); T. C. Ryker (1936-50); S. J. P. Chilton (1940-date); P. H. Dunckelman (1940-date); R. T. Gibbens (1940-41); W. J. Luke (1941-42); F. J. LeBeau (1944-46); J. G. Atkins (1947-date); W. J. Martin (1947-date); E. R. Stamper (1948-date).

The following men from the teaching faculty have carried on projects of their own or have assisted in various ways in the research program: C. F. Moreland, W. N. Christopher, C. A. Brown, L. H. Flint, C. S. McCleskey, L. S. Olive, Mel T. Cook, H. E. Wheeler, H. W. Johnson, and R. E. Atkinson.

The following research men from the U. S. Department of Agriculture have at times been stationed in Louisiana with offices in Louisiana State University: D. C. Neal, E. L. LeClerc, T. P. Dykstra, D. C. Bain and T. T. Ayers at Baton Rouge, and W. H. Tisdale at Crowley.

Much credit should also be extended to the numerous graduate students who have from time to time carried on projects of their own or have assisted in the Experiment Station investigations.

### Louisiana Conditions and Problems

Conditions in Louisiana are extremely favorable for the development and spread of most plant diseases. The rainfall is heavy (close to 60 inches in the sugarcane belt), the humidity is relatively high, and the temperatures are usually favorable during most of the year. The winters



are comparatively mild and plant growth is seldom at a standstill during any period of the year. The number of plants grown is very large, including not only those that are adapted to sub-tropical conditions, but also most short-season crops common to northern climates which find conditions favorable for growth during the winter months. The plant pathologist finds no stopping place in his work, nor any season during which he must confine his investigations to the laboratory or the greenhouse.

During the period covered by this report, which comprises practically the first half of the 20th century, many diseases and disease problems have been under investigation. The major crops such as sugarcane, cotton, rice, vegetable crops, and strawberries have of necessity received the most attention, but the diseases of other crops have been studied as time has allowed. It has also been possible to investigate certain mycological and physiological problems. During recent years, it has been necessary to take over and push weed control problems.

### Sugarcane Diseases

Sugarcane diseases have received a great deal of attention through all the years. Three diseases of major importance, red rot (*Physalospora tucumanensis*), root rot, and mosaic have occurred in the State, along with several others of lesser importance. These diseases have caused and are still causing heavy losses. There have been periods of declining yields and crop failures. The prosperity of the sugar industry depends to a very large extent on the efficiency of the measures that are used to control these diseases. The fact that the 1950 crop was one of the best on record shows that the methods adopted have been fairly efficient.

The red rot was first observed in the State in 1908. In the years that followed, information was obtained on the losses caused by the disease, how the fungus enters the plant, how the spores migrate through the ducts of the fibro-vascular bundles, how the cells of resistant and susceptible plants react to the invading mycelium, and on the occurrence of the perfect stage. The disease reduces the sucrose content of the juice and is also often responsible for poor stands in the field. The mosaic (virus) was recognized in 1919. This disease made it necessary to discard all the varieties that were being grown at that time. At present, with one exception, all varieties grown are resistant. Consequently, the disease has lost much of its importance. The root rot, which is considered to be caused by a complex of factors, is still not very well understood.

The breeding program which has been carried on by the U. S. Department of Agriculture and now also by the Department of Plant Pathology in the Experiment Station has been responsible for the production of canes which are fairly resistant to the major diseases. At present, varieties are not released for planting unless they are resistant.

It is not necessary at this time to present further details in regard to the sugarcane investigations. A bulletin has just been published by the Experiment Station concerning work of the department on sugarcane diseases (Edgerton, C. W. Forty-two years of sugarcane disease research at the Louisiana Agricultural Experiment Station. Louisiana Agr. Exp. Sta. Bul. 448. 1950). A copy of this bulletin may be obtained from the Director of the Experiment Station, L. S. U., Baton Rouge, Louisiana.

### Cotton Diseases

In the earlier period of the work, considerable attention was given to the diseases of cotton affecting the bolls. In 1912, a bulletin on the boll rots of cotton was published. This bulletin, which included the information obtained in Louisiana, has been used as a reference in most cotton-producing countries of the world. In this bulletin, the *Diplodia* boll rot was for the first time listed among the more important cotton diseases. The perfect stage of the cotton anthracnose (*Glomerella gossypii*) was reported and data indicating that both the cotton anthracnose and the angular leaf spot organisms (*Xanthomonas malvacearum*) could gain entrance to the cotton bolls through the deteriorating flower parts was presented. It was also shown that the angular leaf spot lesions on the cotton bolls acted as courts of infection for the anthracnose. It was shown that the cotton anthracnose was carried over from one season to the next by spores on the surface of the seed and by mycelium within the seed. It was also shown that these spores and mycelium would die out during the first year of seed storage. By a longer period of storage, anthracnose-free seed could be obtained.

In later years, Neal carried on seed treatment tests in Louisiana. In the years when most of the seed used for planting was treated, there was very little loss in the State from anthracnose and angular leaf spot. Neal also continued work on the cotton wilt (*Fusarium oxysporum* f. *vasinfectum*) and in the last few years has been observing and studying a small outbreak of Texas



root rot (Phymatotrichum omnivorum) in the northwest corner of the State.

### Diseases of Vegetable Crops

Many vegetables are grown in Louisiana both for local consumption and for shipment to northern markets. From a pathological standpoint, the ones that have received the most attention include: bean, tomato, sweetpotato, Irish potato, eggplant, onion and cucumber.

**Bean Diseases.** In the first decade of the 20th century, most of the bean seed used for planting came from Michigan and other northeastern States. A considerable portion of this seed was affected to a greater or less extent with anthracnose (Colletotrichum lindemuthianum). As conditions in the spring in Louisiana are very favorable for anthracnose, epidemics were common and severe. In studying the disease, it was found that the causal fungus was definitely a low-temperature organism, having an optimum temperature for growth of 22-23° C. and a maximum around 30° C. This meant that clean seed could be obtained from fields planted in August. Later, it was found that the disease did not develop in many regions in the West. In recent years, the growers have depended almost entirely on western-grown seed and the disease has practically disappeared from Louisiana fields.

The bacterial blights (Xanthomonas phaseoli, Pseudomonas phaseolicola) have also been serious and at the present time are the most serious diseases of the bean. While working on these troubles, Person found that it was possible to obtain blight-free seed from certain of the dry valleys in California. For a number of years Louisiana growers contracted for such seed. It is believed that it is possible for seedsmen to obtain bean seed free of the blights as well as of the anthracnose.

**Tomato Diseases.** The investigations on tomato diseases in Louisiana began about 1909. At that time, in many parts of the State, it was impossible to grow the commercial varieties then available because of tomato wilt. Wilt-resistant varieties of certain other crops, particularly cotton, had been obtained, and it was reasonable to expect that wilt-resistant varieties of tomatoes could also be procured. Many varieties were tested in the field and finally a single plant was found that was highly resistant. This plant had certain undesirable characteristics and so was crossed with the Earliana, a variety that was being extensively grown at the time. Eventually two resistant varieties were obtained and were grown on a wide scale in several of the southwestern States for a number of years and are still being grown to some extent. These varieties have also been used by geneticists in various parts of the country for breeding purposes.

In the breeding work in Louisiana, a new method of selecting for resistance was developed. Seeds were planted in sterilized soil re-infested with the wilt fungus. As susceptible plants were either killed or showed the presence of the disease, these were easily eliminated and only plants showing resistance were taken to the field. This method permitted the testing of large numbers of plants.

In the studies on tomato wilt, it was found that the optimum temperature for the growth of the fungus (Fusarium oxysporum f. lycopersici) in culture and for infection in the field was about 29° C. This explains why the tomato wilt is more severe in the Southern States where the temperatures are relatively high in the spring season.

The early blight, Alternaria solani, has also been a very important factor in Louisiana. In early spraying tests, it was found that while the disease could be controlled to a certain extent, the harvest period was also delayed.

**Sweetpotato Diseases.** The sweetpotato is one of the major crop plants in Louisiana. During the first 20 years of the present century, because of declining returns from sugarcane and cotton, farmers centered around Sunset and Opelousas attempted to substitute the sweetpotato and to develop a commercial sweetpotato industry. The attempt was outstandingly successful. The industry gradually enlarged, and finally that area became the leading sweetpotato center in the United States. It must be admitted that the early growers were very fortunate. The industry in its beginning developed without trouble from any serious disease. The growers used their own sweetpotatoes for planting purposes and the use of vine cuttings was a common practice. This method of propagation held the black rot in check and the other serious diseases were not introduced.

During World War II and the years immediately preceding, conditions changed. Owing to increased demands for sweetpotatoes and also a greater demand for early crops, the growers shifted to the use of draws for planting. They also shipped draws and seed potatoes in from other areas. The production of draws for sale developed into an industry of considerable size. The State Department of Agriculture attempted to protect the purchasers of roots and draws by requiring that these materials be certified. This requirement was of considerable help, but in



spite of it the major diseases of sweetpotatoes became established in all of the commercial areas.

There are at present three major diseases of sweetpotatoes in Louisiana, black rot, soil rot, and stem rot (*Endoconidiophora fimbriata*, *Actinomyces ipomoea*, *Fusarium oxysporum* f. *batatas*). The research work in the Experiment Station has largely been concerned with the first two.

The losses from black rot increased enormously during this recent period in which the industry was expanding. As the losses previous to that had been of more or less minor importance, the growers did not take the necessary precautionary measures to hold it under control. It soon became a serious trouble, not only in the field and in storage, but also on roots being shipped to market. Sweetpotatoes are usually washed before shipment. It was found that roots washed in water badly contaminated with spores of the black rot fungus would be seriously affected and sometimes become a total loss before reaching the northern markets. In tests made at the shipping centers, Martin and Person showed that this loss could be largely eliminated by dipping the roots in a weak borax solution. In recent work, results obtained by U. S. Department of Agriculture workers at Beltsville have been confirmed. It has been found that exposing black-rot-affected roots at a temperature of 43° C. for a period of 24 hours destroys the fungus without injuring the roots. Additional work here indicates that exposures of 30 hours at 40° C. also are lethal to the fungus in affected roots. This has not as yet been used commercially but the method looks promising.

The soil rot was first recognized in the vicinity of Sunset in 1934. During the years that followed, it spread rather rapidly and became a disease of considerable importance. Sweetpotato growing was abandoned on some farms. Serious trouble has developed only in dry years.

In Louisiana, as had been suggested earlier in other States, it was found that the disease was caused by an Actinomycete. The organism was isolated and tested and finally in 1940 was described as a new species, *Actinomyces ipomoea*, by Person and Martin.

After extensive tests, Person found that the disease could be controlled in the Sunset region by treating the fields with about 500 lbs. of sulfur per acre. The organism does not live in a soil testing pH 5.2 or lower. The soils around Sunset ordinarily test about pH 4.8, which could be reduced to about pH 5.0 by the addition of sulfur. It was found that potatoes could be grown on such treated soils for several years without additional treatment.

**White Potato Diseases.** In Louisiana, the Irish potato is grown largely for shipment to northern markets in the early spring. The yields are not large but prices in the spring are usually high enough to make the growing of potatoes reasonably profitable. The greatest hazards to the industry have been the occurrence of certain diseases, the most troublesome including the mosaics, ring rot, and late blight, for which climatic conditions in Louisiana are extremely favorable for development in epidemic form. Since these diseases are all seed-borne, and Louisiana growers depend almost entirely upon northern-grown potatoes for planting purposes, control depends to a great extent upon the measures taken by growers in the northern seed-producing States.

Between 1910 and 1920, yield in Louisiana dropped to a point too low for potato growing to be profitable. The cause of the decline was at first not known, but in later years was recognized to be the extremely high infection with certain mosaics, particularly those of the rugose type. Mosaics were just becoming recognized then and even potato pathologists did not appreciate their importance. Also, at that time seed certification programs were just beginning to be set up in a number of the northern States, first aimed mainly at guaranteeing purity as to variety of the seed stocks sold for planting.

In Louisiana, the idea developed that it might be possible to obtain certified seed potatoes from fields showing a minimum of mosaic, or seed stocks from regions in which the mosaic did not spread rapidly. At first, it was not possible to persuade seed certifying agencies to include a tolerance for mosaic of less than 30 to 40 percent, but it did not take long to demonstrate that this high tolerance was entirely unsatisfactory. On the advice of the Experiment Station, a large shipment of several cars of seed potatoes, said to have been obtained from a field showing about 30 percent of mosaic, was purchased and used for planting in Louisiana in 1921. The growers barely did better than to get their seed back. Some fields were not harvested. This very suddenly and very definitely settled the question in the negative as to whether seed potatoes with an appreciable amount of mosaic could be used for planting in Louisiana. Eventually the tolerance for mosaic dropped to around 2 percent. With better and more healthy seed stocks, the acreage planted to potatoes in Louisiana again increased.

The introduction of the ring rot (*Corynebacterium sepedonicum*) into the United States presented some problems which were temporarily disturbing. Recognizing the seriousness of the disease, the Louisiana State Department of Agriculture, on the recommendation of the pathologist of the Experiment Station, placed a zero tolerance on ring rot on certified potatoes shipped into



the State. This worked out very satisfactorily and the losses from ring rot have been relatively small.

During the past six or eight years, epidemics of late blight, some of them very destructive, have occurred in the State. These epidemics had not been expected, as it had been assumed that the late blight fungus (Phytophthora infestans) was a low-temperature organism and would not develop under normal Louisiana conditions. In studying the disease, Martin has isolated strains that show marked differences in their ability to survive exposures at 36° C. Whether the disease will continue to be an important factor in the production of potatoes in Louisiana is still not clear.

Onion Diseases. Of the various diseases which attack onions and shallots in Louisiana, the downy mildew and pink root (Peronospora destructor, Pyrenochaeta terrestris) seem to be the most important. These diseases have from time to time been responsible for declining yields and also crop failures. In the years between 1918 and 1921, a survey was made to determine what diseases were present and attempts were also made to control the mildew with sprays. Bordeaux mixture and Bordeaux with a sticker were used. The waxy surface of the leaves prevents proper covering with the sprays and the results obtained were not considered satisfactory.

In recent years, Tims has tested many fungicides and stickers with varying results. Tims has also reported on white rot (Sclerotium cepivorum) and several virus diseases which have become established in the State. He is now testing a large number of hybrids hoping that he can find one of good quality and also resistant to mildew.

Cucumber Diseases. The growing of cucumbers is an important industry in certain small areas of the State. Success in growing this crop, however, has always depended upon how well the growers have been able to control the two important diseases, downy mildew and anthracnose. Downy mildew (Pseudoperonospora cubensis) develops practically every year while anthracnose (Colletotrichum lagenarium) seems to be important only in wet years.

Bordeaux mixture has been used intermittently for many years to control the mildew. It was apparently first used shortly after information in regard to it was brought back from Europe by some of the U. S. Department of Agriculture investigators in the last decade of the 19th century. Experiments by the Louisiana Experiment Station on the control of the two diseases have been in progress for 10 years or more under the direction of Plakidas, LeBeau, and Atkins. It has been found that Bordeaux mixture will control downy mildew but that considerable injury from burning is often associated with its use. Bordeaux mixture, however, does not control anthracnose, and there have been disappointments in the past in years when the conditions were favorable for the development of this disease. In recent years, the newer fungicides have been tried and it has been found that certain of them, particularly Fermate and Dithane Z-78, will control both the mildew and the anthracnose.

### Cereal Diseases

Investigations have been carried on with the diseases of two of the important cereals grown in Louisiana, rice and oats. Rice is one of the crops of major importance, being grown mainly in Southwest Louisiana, and along the Mississippi River and some of the bayous in the southern part of the State. Oats are grown to a limited extent in various parts of the State, both for winter grazing and for the production of grain.

Rice Diseases. A report on the rice diseases of Louisiana was made by Fulton as early as 1908. He found four diseases in the State: blast (Piricularia oryzae), green smut (Ustilagoidea virens), black smut (Tilletia [Neovossia] horrida), and a specking of the grains primarily caused by an insect.

Other diseases have since been recognized in the State. The Cercospora leaf spot, which has been one of the more important, was studied by Ryker and Chilton, who were able to select varieties that were temporarily resistant. They found, however, that there were many strains of Cercospora oryzae differing in pathogenicity. Varieties selected for resistance eventually became attacked by strains which seemed to be new. About six or eight different strains of the fungus were isolated and tested.

Other diseases being studied at the present time include Sclerotium stem rot and white tip (Leptosphaeria calvinii).

Because of recommendations made by the Experiment Station, many growers are now treating their seed before planting. When conditions for growth have not been satisfactory, better stands have been obtained with treated seed.

Oat Diseases. Brief mention may be made of two of the more important oat diseases, crown rust and Helminthosporium blight. Climatic conditions in Louisiana are extremely favorable for the development and spread of crown rust (Puccinia coronata). For years, the growers were compelled to depend entirely on varieties of the Texas Red Rustproof group of oats. As a result



of the oat-breeding program, newer varieties eventually became available. These were checked closely, not only for resistance to rust, but for other desirable characters. The Victoria and Bond hybrids were found to be especially valuable. These were accepted by the growers and for a period of years were the leading varieties in the State.

In a study made of crown rust, Forbes found that the urediniospores do not live over the summer season in Louisiana. This meant that the spores responsible for the initial infections of crown rust in December and January must come from outside the State.

The *Helminthosporium* blight (*H. victoriae*) was responsible for a change in the oat program. The disease did not enter the State for two or three years after it had caused trouble in other regions. Because of the very favorable conditions in Louisiana, it seemed probable that the disease would be very troublesome. Consequently when the disease was first reported in the State, a letter was sent to all county agents and to the principal oat growers, recommending that no further plantings of the Victoria hybrids be made. Fortunately, this recommendation was very generally followed and the losses from this disease were held to a minimum. Later, studies of the disease were made by Stamper and Atkins and it was shown that there is little chance of growing the present Victoria hybrids in southern and central Louisiana.

### Forage Crop Diseases

A survey was made of the sorghum plantings in the State by Bain in order to determine what diseases might be causing serious losses. At the time the survey was made there was a possibility that the crop might be used for the production of sugar as well as for forage. A new disease, apparently recently introduced, was found. The cause was a fungus described as *Gloeocercospora sorghi* by Bain and Edgerton. The disease has since been found in a number of States, not only on sorghum but also on corn and a few other grasses.

### Fruit Diseases

Of the several fruits that are grown in Louisiana the strawberry is most important. Others of lesser importance include figs, pears, peaches, and species of *Rubus* and *Citrus*.

**Strawberry Diseases.** The strawberry is grown very extensively in the southwest part of the State, being the principal crop in Tangipahoa and parts of Ascension and Livingston Parishes. The industry was built on the Klondyke variety, which originated in Louisiana many years ago. For a long period there was little trouble, but eventually, as the industry expanded, Klondyke became severely attacked by leaf spot and to a lesser extent by the leaf scorch and strawberry-growing declined. To determine the possibility of control of these diseases, extensive tests were made by Plakidas in various parts of the strawberry belt and found that almost complete control could be obtained by spraying with Bordeaux mixture. As a result of these tests, spraying is practiced very generally by most growers and has very definitely kept the industry in a prosperous condition. The Bordeaux mixture apparently acts as an eradicant fungicide, the fungus fruiting structures being killed before the spores are produced. Plakidas has also made an extensive study of the fungi causing leaf spot and leaf scorch (*Mycosphaerella fragariae*, *Diploncarpon earliana*), determining how these fungi enter the strawberry leaf and cause infection.

Plakidas also made some investigation on the strawberry dwarf, a disease now known to be caused by nematodes (*Aphelenchoides*). As the disease seems to be of little economic importance, it has received but little attention in recent years. A new leaf spot which appeared rather suddenly was also studied. This was called the purple leaf spot and the organism causing it was described by Plakidas as a new species, *Mycosphaerella louisianae*.

In recent years strawberry varieties have changed and new pathological problems are developing which eventually will have to be considered if the industry is to be maintained at a high level.

**Fig Diseases.** Figs are grown in Louisiana mostly for home use and for sale locally. As the fruits are attacked very quickly by rot organisms after picking, they are rarely shipped to distant markets. As early as 1911, Edgerton reported on the diseases of figs then known to occur in the State, including several diseases caused by well-known organisms, such as anthracnose (*Glomerella cingulata*), soft rot (*Rhizopus nigricans*), rust (*Physopella fici*), leaf spot (*Cercospora fici*), and nematode root galls. Besides these, canker and limb blight were listed as new. Canker, which develops around the old fruit scars, is caused by a fungus described as *Tubercularia fici*. The limb blight occurs on the limbs and branches and covers them with the conspicuous salmon-colored fructifications. The fungus which causes the disease is now known to be *Corticium salmonicolor*, although at the time it was incorrectly identified. This was one of the first reports of this tropical fungus on living trees in the United States.



In later years other fig diseases appeared, some of them apparently coming in from regions farther to the south, possibly from the tropics.

An interesting twig blight caused by the fungus Stilbum cinnabarinum (perfect stage, Megalonectria pseudotrichia) appeared on figs about 1932 and was studied by Tims. The disease caused death of the twigs, which were covered with the bright red fruiting structures. It spread rapidly and soon was widespread in all parts of south Louisiana. For some reason which has not been satisfactorily explained, the disease, after reaching its peak, gradually became less common and in a few years almost disappeared.

Leaf blights caused by Rhizoctonia-like fungi have been the most troublesome during the past 30 years. As shown by Tims, the organisms involved include the thread-blight fungus, Pellicularia koleroga, and one or more strains of Pellicularia filamentosa. Very commonly large branches are involved and sometimes the trees are killed. The thread-blight fungus maintains itself by rhizomorphs on the bark and so is difficult to control. Some control has been obtained by spraying with eradicant and protectant fungicides.

Two new leaf spots have been reported in south Louisiana in recent years. The organisms causing them were described by Tims and Olive with the following names, Cephalosporium fici and Ormathodium fici.

Pear Diseases. The pear blight (Erwinia amylovora) limits very definitely the pear varieties that can be grown in Louisiana. The varieties grown are mainly members of the resistant Chinese Sand pear group, the pineapple variety being the one usually planted. For years, this variety seemed to be free of any serious disease. About eight or ten years ago, however, the pear leaf-blight fungus, Fabraea maculata, entered the State, first appearing in the eastern part and gradually spreading westward. The Pineapple pear is extremely susceptible to this fungus and it is not uncommon to see trees practically defoliated. Plakidas found that the fungus overwinters in the dead leaves on the ground and attacks the new leaves near the ground very early in the spring. The disease can be controlled by spraying with copper fungicides or with Fermate, but very few growers follow the recommendations.

The Pineapple pear is also very susceptible to the root rot caused by Clitocybe tabescens. Many trees have been killed by this fungus. Plakidas was able to reproduce the disease by inoculating with pure cultures.

Rubus Diseases. Very few attempts have been made in Louisiana to grow species of Rubus on a commercial scale. Wild species of blackberries and dewberries grow in such profusion and the production of fruit is so great that there is little need of commercial plantings. A number of diseases attack Rubus plants in Louisiana and some of these undoubtedly would be important if blackberries or dewberries were to be grown on a commercial scale. One of these, rosette, has been investigated by Plakidas. In some other sections of the country, this disease is known as double blossom. It is characterized by the presence of numerous short branches giving a rosette appearance. The flowers are enlarged and severely distorted and fruit formation is prevented. It was found that the causal fungus had not been properly classified and it was renamed Cercospora rubi. The disease is very interesting because of the peculiar host-parasite relationships. The mycelium does not enter the host cells but remains between the bud scales and the different flower parts, in close association with the embryonic bud elements. Infection takes place in the early spring on the young primocanes. Control was obtained by cutting back the young primocanes and by spraying with Bordeaux mixture.

Citrus Diseases. While the citrus industry in Louisiana has never been large, it has been very important in certain areas, especially along the Mississippi River below New Orleans. The Department of Plant Pathology of the Experiment Station cooperated closely with the United States Department of Agriculture and the State Department of Agriculture in the citrus canker eradication program, during which, with the exception of a small area from slightly above Buras to the mouth of the River, most of the citrus plantings in the State were destroyed. At present the disease seems to be totally eradicated. During the past year, another very serious disease has appeared in the main citrus-growing area of the State, and already has been responsible for the death of hundreds of trees grafted on sour orange stock. It seems to be identical with or at least very similar to the quick decline of California and the tristeza of Brazil. The disease has been reproduced by grafting.

#### Diseases of Ornamentals

During the past few years, interest in the growing of ornamentals in Louisiana, as well as in other parts of the South, has increased greatly. As a result, growers as well as nurserymen are recognizing the diseases that are present and are increasingly requesting information in regard to control measures. During recent years, the Department of Plant Pathology has been trying to



anticipate the problems that are apt to become important and has started investigations on some of them. As yet, Easter lilies, Oriental arborvitae, *Pittosporum*, and Camellias have received the most attention.

**Easter Lily Diseases.** The growing of Easter lily bulbs in southern Louisiana for shipment to northern markets has at times been an important industry and would become very important if satisfactory control measures could be found for some of the serious diseases. The virus diseases and the black scale have been the most important. Several virus diseases are present and some of them are serious enough to prevent the growing of bulbs on a commercial scale. Attempts have been made to control these troubles by roguing and by certification measures, but the results have not been satisfactory. Investigations on the black scale have been more encouraging. This disease is caused by a fungus which Plakidas has named *Colletotrichum lilii*. The scales are affected and the bulbs do not grow satisfactorily. Investigations by Plakidas and LeBeau have shown that it is possible to destroy the fungus by soaking the bulbs for about 48 hours in a Puratized solution.

**Oriental Arborvitae Disease.** For a time, the Oriental arborvitae was among the more important ornamentals planted. Very commonly, however, this plant was affected with a blight which killed the branches. In studying the disease, Plakidas found that it was caused by a fungus which he described as *Cercospora thujina*. He also found that the disease could be controlled by spraying with Bordeaux mixture and other copper fungicides. Because of this disease the arborvitae is being planted less and less.

**Pittosporum Leafspot.** A leafspot on *Pittosporum* appeared quite suddenly a few years ago. Plakidas studied the disease and described the organism causing it as *Cercospora pittospori*.

**Camellia Diseases.** At present in Louisiana there is more interest in Camellias than in other ornamental plants. As conditions must be just right for Camellias, troubles have developed from time to time. Plakidas has been studying the die-back, which seems to involve soil conditions as well as attack by certain fungi. He has also been investigating certain scab diseases. Some of these are caused by species of *Sphaceloma* (Elsinoë), and the cause of others is perhaps physiological. The flower blight, caused by a species of *Sclerotinia*, has also appeared in the State and at present is causing much concern.

### Mycological Investigations

From time to time, certain strictly mycological problems have received considerable attention. The investigations have involved not only parasitic organisms but also many others which have seemed of particular interest or importance. Many of the fungi, on account of the short life cycle and the ease with which they can be handled, are excellent for working out certain basic, biological principles. The mycological investigations have included not only life cycle studies but also taxonomic, physiologic, and cytologic studies.

As a result of the taxonomic studies, many new organisms have been described and more information has been obtained in regard to certain groups of fungi. For example, the Louisiana species of *Synchytrium* have been studied by M. T. Cook over a period of several years. Much information is now available in regard to the species of this very interesting genus.

Among the more interesting physiologic and cytologic investigations, the work with antibiotic organisms and the studies made with *Glomerella* should be mentioned.

**Antibiosis Investigations.** During the whole course of the investigations covered by this report, antagonistic or antibiotic organisms living in the soil have been recognized as very important in eliminating certain pathogenic organisms and in determining the nature of the soil flora, and indirectly soil fertility. In one of the early publications on the bean anthracnose, it was shown that certain soil organisms, particularly a species of *Fusarium*, were important in killing out the anthracnose fungus in lesions on the seeds and on the emerging cotyledons.

Later, while the sugarcane root rot was being investigated, Tims isolated an Actinomycete which he reported in 1932 as being definitely antagonistic to the root-rot *Pythium*. In 1938, LeBeau reported that a species of *Trichoderma* could under some conditions destroy this *Pythium*.

In recent years, Cooper and Chilton made a survey of the Actinomycetes in the soils of the Sugar Belt that were antibiotic to the root rot *Pythium*. From 18 to 31 percent of the Actinomycetes isolated were definitely antibiotic to *Pythium* in culture.

**Glomerella Investigations.** Fungi of the genus *Glomerella* have been found to be extremely valuable for physiologic, cytologic and genetic studies. In 1912, Edgerton reported that with some of these, two strains designated plus and minus commonly occur. It was shown that when the two strains were placed in a culture plate, a dense ridge of perithecia formed on the line of contact where they grew together. In 1940 Chilton initiated genetic studies on this organism, and Lucas, Wheeler, McGahen, Ernest and Olive, have used various *Glomerella* strains for



genetic, physiologic and cytologic studies, and a series of papers based on these studies has been published. At present, the radioactive isotope,  $C^{14}$ , is being used by Wheeler in some of the investigations.

### Weed Control Investigations

In recent years, interest in weeds and weed control has increased very rapidly in Louisiana as well as in other parts of the United States. At the present time many States, including Louisiana, have active projects on weed control. The present interest may be said to have had its beginning when it was discovered that certain weeds were very sensitive to 2, 4-D and could be killed by extremely small amounts of this chemical when applied in dusts or sprays. In Louisiana, investigations have been mainly in the Department of Botany and Plant Pathology, but with the cooperation of the Department of Agricultural Engineering.

Weed control investigations in Louisiana started when the State Legislature in 1944 made an appropriation to the Experiment Station for the eradication of the alligator weed (Alternanthera phylloxeroides), which had become a very serious pest in sugarcane fields in South Louisiana. A project was set up in the Department of Botany and Plant Pathology. At the time it was realized that it might be very difficult to find satisfactory control measures for this weed. To begin with, the various herbicides then known were tested. Fortunately, shortly after the work started, 2, 4-D became available and this chemical was immediately included in the tests then being made by Brown and Ryker. The alligator weed was found to be very sensitive to 2, 4-D and the planters were quick to follow the control recommendations made by the Department. As a result, in two to three years time, this weed ceased to be a problem in cultivated fields. At the same time, Ryker also demonstrated that a number of the important weeds in rice fields could be controlled with 2, 4-D.

As the results obtained from the preliminary investigations on weed control were so encouraging, it was only natural for the farmers and the planters in the State to insist that the weed projects be enlarged and that attempts be made to find successful control measures for some of the other serious weeds of the State. In cooperation with many of the chemical companies interested in herbicides, extensive investigations have been made on the control of a number of the important weeds, including Johnson grass and the weeds in cotton fields. Johnson grass is unquestionably the most troublesome weed in the State, and because it spreads by both rhizomes and seed, it is a very difficult plant to eradicate. Very promising results have been obtained by combining summer fallow with pre-emergence and post-emergence sprays. In 1951, many planters will use every effort to control Johnson grass in their fields. In the extensive tests in the cotton weed investigations, it has been necessary to use contact herbicides such as the oils and dinitro compounds, with some very encouraging results. In 1951, tests will be made on a large scale.

### Graduate Instruction

During the past 20 years graduate instruction and graduate work in general in the Department of Botany and Plant Pathology have expanded rapidly. This expansion has been aided by a grant from the General Education Board and by the establishment of graduate fellowships by Louisiana State University. With the exception of the war years, there have been from 15 to 25 registered graduate students each year. In this period, more than 80 Master of Science degrees and 19 Doctor of Philosophy degrees have been granted. The graduate students have mostly worked very closely with the research men in the Department.

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